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DISTRICT-WIDE COMPARATIVE STUDY OF THE RESOURCE USE EFFICIENCY OF FENUGREEK CROP

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ABSTRACT

Two districts Sikar (Shri-Madhopur Mandi) and Jaipur (Chomu Mandi) were selected to study district-wide comparison of the resource, use efficiency of fenugreek crop; as being Rajasthan state is a major producer of the fenugreek. A sample of 150 farmers was selected on the basis of systematic sampling from the cumulative total 615 (261 in Sikar and 354 in Jaipur). The regression coefficient (linear and non-linear), auto-correlation, multicollinearity, autocorrelation, returns to scale were applied on collecting data by a Cobb-Douglas production function to work out the resource use efficiencies in fenugreek crop. Machine Labor had a significantly positive effect on the gross return of small, semi-medium, medium and large group of Jaipur farms and Sikar farms. Manure significantly and positively influenced the gross return of marginal forms of Jaipur and Sikar farms. Fertilizer positively and significantly influenced the gross return on small, semi-medium, medium and large categories of Jaipur and on small and medium categories of Sikar farms. Plant protection positively significantly on semi-medium farm of Sikar influenced the gross return. Irrigation positively and significantly influenced the gross return of semi-medium, medium and overall category of Jaipur farms and small, semi-medium, medium and large category of Sikar farmers. Human labor significantly and positively influenced the gross return of small or overall group of farms of Jaipur and Sikar farms.

KEYWORDS: Resource Use, Efficiency Fenugreek, Jaipur & Sikar

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Original Article

INTRODUCTION

Rajasthan is one of the foremost fenugreek producing state in India. The state has huge prospective for increasing the productivity and production of fenugreek seed to meet out the growing export claim. The oscillation in the production of fenugreek was due to the variation in weather circumstances, area under the crop and yield of the crop, which affects the employment and income distribution and impede the economic growth of the state (Kumawat *et.al.* 2016).

Sensible use of resources together with appropriate technology plays an imperative role in stepping up agricultural production. It is normally noticed that the farmers are not using suggested level of farm resources with suitable technology. This result increases the gap between the potential yield and the actual yield. Resource use efficiency in agriculture is defined as inclusion of the broad concept of technical efficiency, allocative efficiency and environmental efficiency to increase the productivity in terms of the income; thus a professional farmer allocates his land, labor, water and other resources in the most advantageous manner, so as to maximize his returns, at least cost, on a sustainable basis (Kumawat *et.al.*, 2017).

Singh and Beena (1996) have conducted a study on resource use efficiency in cash crops of Pune District

(Maharastra) by estimating Cobb-Douglas production function. The coefficient of human labor was positive and significant in onion indicating that there was an excess use of fertilizer in this crop. Lindara *et. al.* (2006) conducted a study on technical efficiency in the spice based agro-forestry sector by selecting 127 Agra-forestry farmers in six divisional secretariats in the Matale district of Sri Lanka. Stochastic frontier production function with Cobb -Douglas model was used for data analysis. They observed that hired labor, organic fertilizer, inorganic fertilizers, land size and soil conservation measures showed a significant positive effect on the Agra-forestry production. Nimoh *et. al.* (2013) conducted a study to determine the resource use efficiency in rice production. The Cobb-Douglass production function and regression results indicated that the farmers were on the second stage of the production function, which were decreasing returns to scale.

The economic analysis of the marketing of fenugreek in Rajasthan was reported by Kumawat *et.al.* (2017). Although, Kumawat *et. al.* (2017) has reported in Rajasthan that only five variables viz. Machine Labor, seed, fertilizer, irrigation and machine labor were significantly affected the gross return of fenugreek crop in their study of the resource use efficiency of fenugreek crop in the state of Rajasthan. The present research work was the district-wise comparison of the resource, use efficiency of fenugreek crop to investigate geographical and professionalism of farmers.

METHODOLOGY

This research work is one of the preceding works, which was published by Kumawat *et. al.* (2017), in the International Journal of Agricultural Science and Research. Thus, the adopted methodology was as similar as in the above citation.

RESULTS AND DISCUSSIONS

Here, an attempt has been made to study and compare the efficiency of existing factor combinations of Jaipur and Sikar farmers. The Cobb-Douglas production function was applied to work out the resource use efficiencies in fenugreek crop in both regions, so as to suggest changes in combinations of resources in the optimal direction. This section is divided into following sub-heads. Out of these maximums (27.33 per cent) farmers belonged to a semi - medium group followed by small (23.34 per cent), medium (22.67 per cent), margin (15.33 percent) and large (11.33 percent) groups. In Jaipur district, maximum per cent was of small farmers (25.29 per cent); while in Sikar district the maximum percent (31.75) was of a semi - medium farmer.

Regression Analysis

For analyzing resource use efficiency in fenugreek crop on different size groups of farmers of Jaipur and Sikar districts, multiple regression functions were estimated by taking the gross return as the dependent variable (Y) and machine labor (X_1), seed (X_2), manure (X_3), fertilizers (X_4), plant protection measures (X_5), irrigation (X_6) and human labor (X_7), as the independent variables. Both linear and log-linear (Cobb-Douglas) forms of production relationships were estimated using the ordinary least squares (OLS) technique. Overall analysis was also attempted to identify the causal factors of gross return in the study area at the aggregate level. Based on the value of R^2 and‘t’ test (*i.e.*, standard errors of the regression coefficients) the Cobb-Douglas production function was used due to the high value of coefficient of multiple determination obtained and preferred because of the computational ease and theoretical fitness of agriculture data.

The possibility of autocorrelation among the estimated residuals was also tested with the help of Durbin–Watson test. For deciding on the presence of multicollinearity as well as the best set of explanatory variables for the regression model, the stepwise regression method (stepwise forward regression) was followed. In this method one variable at a time

was included in the model. The decision to add a variable was made on the basis of the contribution of that variable to the error sum of squares as judged by the F-test.

REGRESSION ANALYSIS OF JAIPUR

Marginal Farmers

The values of VIF (variance inflation factor) for the two selected explanatory variables were estimated to be less than ten indicating no multicollinearity problem among these variables. The estimated'd' value was compared with a table value corresponding to n = 11 and K = 2 (K being the number of explanatory variables excluding the intercept) at the 1 per cent level of significance. Since the computed 'd' value (1.794) lay within the bounds of du < 1.794 < 4 –du, i.e., of 1.297 < 1.794 < 2.284 indicating no autocorrelation among the estimated residuals at 1 per cent level of significance (Table 1).

Table 1: Estimated Cobb-Douglas Production Function for Marginal Farmers of Jaipur

Dependent Variable (y) = Gross Return Number of Farmers (N) = 14					
S. No.	**Explanatory Variable**	**Regression Coefficient**	**Standard Error**	**VIF**	**Elasticity Coefficient**
1.	Intercept (a)	1.288	0.184	-	-
2.	Seed (X_2)	0.636***	0.129	4.775	0.636
3.	Manure (x_3)	0.430**	0.120	1.959	0.430

Coefficient of multiple correlation (R) = 0.984; Coefficient of determination, R2 = 0.968; Adjusted coefficient of determination ($\overline{R^2}$) = 0.962; 'd' statistic = 1.794; 'f' value (with 2, 11 d.f.) = 163.971; Returns to scale = 1.066; *** Significant at 1 per cent level of significance; ** Significant at 5 per cent level of significance

The coefficient of seed (X_2 = 0.636) was significantly positive at 1 per cent level of significance. It means the gross return has increased with the increase in expenditure on seed because Jaipur farmers used small quantities of seeds. The coefficient of manure (X_3 = 0.430) was significantly positive at 5 per cent level of significance. These two explanatory variables together accounted for 96.80 percent variation in the gross return (i.e. Dependent variable Y). The observed F-value (163.97) for R was higher than the tabulated F value with (2, 11) degrees of freedom indicating regression to be significant. The elasticity coefficients of gross return with respect to seed and manure were estimated to be 0.636 and 0.430, respectively. This indicated that 1 per cent increase in expenditure on seed and manure led to increase in the gross return by 0.636 per cent and 0.430 per cent, respectively. The sum total of elasticity coefficients, i.e., returns to scale of production was 1.066 on marginal farms in the district implying increasing returns to scale.

Small Farmers

Three explanatory variables, namely; machine labor (X_1), human labor (X_7) and fertilizer (X_4) significantly affected the gross return. No problem of multicollinearity and autocorrelation was observed among these variables. The regression coefficient for machine labor (X_1 = 0.416) and human labor (X_7 = 0.278) were significantly positive at 1 per cent level of significance. The coefficient of fertilizer (X_4 = 0.213) was significantly positive at 5 per cent level of significance (Table 2). The coefficient of determination (R^2) was 0.965 indicating that 96.50 per cent of the variation in gross return was explained by the explanatory variable included in the model. The observed F-value (164.95) for R was higher than the tabulated F value with (3, 18) degrees of freedom, indicating regression to be significant, *i.e.*, the explanatory variables included in the model were significant explanatory factors of the variation in the gross return. The elasticity coefficients of gross return with respect to the explanatory variables, *i.e.*, machine labor, human labor and fertilizer were estimated to be 0.416, 0.278 and 0.213, respectively. This indicated that one per cent increase in expenditure of machine labor, human

labor and fertilizer increased the gross return by 0.416 per cent, 0.278 per cent and 0.213 per cent implying that gross return was relatively inelastic to the changes in amount of machine, human labor, and fertilizer. The returns to scale of production on small farms were 0.907 implying decreasing returns to scale.

Table 2: Estimated Cobb-Douglas Production Function for Small Farmers of Jaipur

Dependent Variable (Y) = Gross Return Number of Farmers (N) = 22					
S. No.	**Explanatory Variable**	**Regression Coefficient**	**Standard Error**	**VIF**	**Elasticity Coefficient**
1.	Intercept (a)	2.048	0.245	-	-
2.	Machine labour (X_1)	0.416***	0.098	5.019	0.416
3.	Human labor (x_7)	0.278***	0.088	5.901	0.278
4.	Fertilizer (x_4)	0.213**	0.091	6.429	0.213

Coefficient of multiple correlation (R) = 0.982; Coefficient of determination (R^2) = 0.965; Adjusted coefficient of determination ($\overline{R^2}$) = 0.959; 'd' statistic = 1.569; 'f' value (with 3, 18 d.f.) = 164.947; Returns to scale = 0.907; *** Significant at 1 per cent level of significance; ** Significant at 5 per cent level of significance

Semi-Medium Farmers

There were no multicollinearity and autocorrelation problem among the selected variables. The regression coefficient for irrigation (X_6 = 0.206) significant at 10 per cent and machine labor (X_1 = 0.408) and fertilizer (X_4 = 0.373) were significantly positive at 1 per cent level of significance. These variables explained 97.00 per cent of the variation in gross return. The elasticity coefficients for gross returns were estimated to be 0.206, 0.408 and 0.373 for irrigation, machine labor and fertilizer respectively. This indicated that one per cent increase in the expenditure on irrigation, machine labor and fertilizer increased the gross return by 0.206, 0.408 and 0.373 per cent, respectively, indicating the gross return to be relatively inelastic to the changes in these variables. The sum of elasticity coefficients was worked out to be 0.987 implying decreasing returns to scale on such farms Table 3.

Table 3: Estimated Cobb-Douglas Production Function for Semi-Medium of Jaipur

Dependent Variable (Y) = Gross Return Number of Farmers (N) = 21					
S. No.	**Explanatory Variable**	**Regression Coefficient**	**Standard Error**	**VIF**	**Elasticity Coefficient**
1.	Intercept (a)	1.385	0.155	-	-
2.	Irrigation (X_6)	0.206*	0.118	9.425	0.206
3.	Machine labour (x_1)	0.408***	0.068	2.803	0.408
4.	Fertilizer (X_4)	0.373***	0.114	8.374	0.373

Coefficient of multiple correlation (R) = 0.985; Coefficient of determination (R^2) = 0.970; Adjusted coefficient of determination ($\overline{R^2}$) = 0.965; 'd' statistic =.473; f' value (with 3, 17 d.f.) = 182.860; Returns to scale = 0.987; * Significant at 10 per cent level of significance; *** Significant at 1 per cent level of significance

Medium Farmers

Irrigation (X_6), machine labor (X_1) and fertilizer (X_4) were the significant factors that affected the gross return on medium farmers in the district. The values of VIF revealed that there was no multicollinearity problem among these variables. The estimated value of Durbin–Watson'd' statistic indicated no autocorrelation (neither positive or nor negative) among the estimated residuals. The regression coefficients of the selected explanatory variables, *i.e.*, irrigation (X_6 = 0.299), machine labor (X_1 = 0.394) were significant at one percent and fertilizer (X_4 = 0.280) were found to be statistically significant at 5 per cent level of significance implying that with the increase in the expenditure on irrigation, machine labor

and fertilizer the gross return increased (Table 4). The variables together accounted for 98.10 percent variation in the gross return. The observed F-value (259.56) for R was higher than the tabulated F value with (3, 16) degrees of freedom indicating regression to be significant. The elasticity coefficients for a gross return with respect to the selected explanatory variables indicated that one per cent increase in expenditure on irrigation, machine labor and fertilizer increased the gross return by 0.299 per cent, 0.394 per cent and 0.280 per cent, respectively. This revealed that gross return was relatively inelastic to the changes in the amount put in irrigation, machine labor and fertilizer. Returns to scale of production on semi-medium Jaipur farms was 0.973 implying decreasing returns to scale.

Table 4: Estimated Cobb-Douglas Production Function for Medium Farmers of Jaipur

Dependent Variable (Y) = Gross Return Number Of Farmers (N) = 20					
S. No.	**Explanatory Variable**	**Regression Coefficient**	**Standard Error**	**VIF**	**Elasticity Coefficient**
1.	Intercept (a)	2.474	0.143	-	-
2.	Irrigation (X_6)	0.299***	0.083	7.552	0.299
3.	Machine labor (x_1)	0.394***	0.081	5.388	0.394
4.	Fertilizer (x_4)	0.280**	0.096	8.195	0.280

Coefficient of multiple correlation (R) = 0.990; Coefficient of determination (R^2) = 0.981; Adjusted coefficient of determination ($\overline{R^2}$) = 0.977; 'd' statistic = 1.760; 'f' value (with 3, 16 d.f.) = 269.565; Returns to scale = 0.973; *** Significant at 1 per cent level of significance; ** Significant at 5 per cent level of significance

Large Farmers

Only two explanatory variables, namely; machine labor (X_1) and fertilizer (X_4) significantly affected the gross return on large Jaipur farms. The values of VIF (variance inflation factor) for the two selected explanatory variables were estimated to be less than ten indicating no multicollinearity problem among these variables. The Durbin –Watson test also indicated that there is no autocorrelation (neither positive nor negative) among the estimated residuals. The effect of machine labor (X_1 = 0.540) and fertilizer (X_4 = 0.340) on the gross return was significantly positive. These two explanatory variables together accounted for 95.60 percent variation in the gross return. The elasticity coefficients of gross return with respect to both the explanatory variables were estimated to be 0.540 and 0.340 for machine labor (X_1) and fertilizer (X_4), respectively, indicating that the gross return was relatively inelastic to the change in machine labor and fertilizer. Return to scale of production on large farmers was 0.880 implying decreasing returns to scale (Table 5).

Table 5: Estimated Cobb-Douglas Production Function for Large Farmers of Jaipur

Dependent Variable (Y) = Gross Return Number of Farmers (N) = 10					
S. No.	**Explanatory Variable**	**Regression Coefficient**	**Standard Error**	**VIF**	**Elasticity Coefficient**
1.	Intercept (a)	1.630	0.422	-	-
2.	Machine labour (x_1)	0.540**	0.199	5.367	0.540
3.	Fertilizer (x_4)	0.340**	0.137	3.264	0.340

Coefficient of multiple correlation (R) = 0.976; Coefficient of determination (R^2) = 0.956; Adjusted coefficient of determination ($\overline{R^2}$) = 0.938;'d' statistic = 1.711; 'f' value (with 2, 11 D.F.) = 69.095; Returns to scale = 0.880; ** Significant at 5 per cent level of significance

REGRESSION ANALYSIS OF SIKAR

Marginal Farmers

The regression results revealed that manure and seed were the significant factors affecting gross returns on the marginal farms of Sikar district.

Table 6: Estimated Cobb-Douglas Production Function for Marginal Farmers of Sikar

Dependent Variable (Y) = Gross Return Number of Farmers (N) = 9					
S. No.	**Explanatory Variable**	**Regression Coefficient**	**Standard Error**	**VIF**	**Elasticity Coefficient**
1.	Intercept (a)	0.945	0.252	-	-
2.	Manure (x_3)	0.792***	0.134	5.334	0.792
3.	Seed (x_2)	0.248**	0.078	1.097	0.248

Coefficient of multiple correlation (R) = 0.995; Coefficient of determination (R^2) = 0.989; Adjusted coefficient of determination ($\overline{R^2}$) = 0.985;'d' statistic = 1.681; 'f' value (with 2, 6 d.f.) = 272.200; Returns to scale = 1.040; *** Significant at 1 per cent level of significance; ** Significant at 5 per cent level of significance

The values of VIF for these explanatory variables ranged for 5.334 to 1.097 indicating no multicollinearity problem among them. The estimated'd' value indicated no autocorrelation (neither positive nor negative) among the estimated residuals at 1 per cent level of significance. The effect of manure (X_3 = 0.792) was significantly positive at 1 per cent level of significance and that of seed (X_2 = 0.248) at the 5 per cent level of significance. These two explanatory variables together accounted for 98.90 percent variation in the gross return. The observed F-value of R was higher than the tabulated F value indicating regression to be significant. The elasticity coefficients for gross returns with respect to both explanatory variables were estimated to be 0.792 and 0.248 for manure and seed, respectively. This indicated that a one percent increase in human labor led to increase in the gross return by 0.792 per cent and manures by 0.248 per cent implying that gross return was relatively inelastic to the changes in amount of seed and manures. Returns to scale of production for marginal farmers was estimated to be 1.040 implying increasing returns to scale (Table 6).

Small Farmers

Human Labor (X_7), irrigation (X_6) and fertilizer (X_4) significantly affected the gross return on smaller farms.

Table 7: Estimated Cobb-Douglas Production Function for Small Farmers of Sikar

Dependent Variable (Y) = Gross Return Number of Farmers (N) = 13					
S. No.	**Explanatory Variable**	**Regression Coefficient**	**Standard Error**	**VIF**	**Elasticity Coefficient**
1.	Intercept (a)	2.462	0.186	-	-
2.	Human labour (x_7)	0.434***	0.094	8.897	0.434
3	Irrigation (x_6)	0.301**	0.104	9.193	0.301
4.	Fertilizer (x_4)	0.217**	0.084	7.321	0.217

Coefficient of multiple correlation (R) = 0.995; Coefficient of determination (R^2) = 0.989; Adjusted coefficient of determination ($\overline{R^2}$) = 0.986; 'd' statistic = 1.943; 'f' value (with 3, 9 d.f.) = 247.508; Returns to scale = 0.952; *** Significant at 1 per cent level of significance; ** Significant at 5 per cent level of significance

The results show that there were no problems of multicollinearity and autocorrelation among these variables. The regression coefficients for human labor (X_7 = 0.434) was significantly positive at 1 per cent level of significance, and for irrigation (X_6 = 0.301) and fertilizer (X_4 = 0.217) were significantly positive at 5 per cent level of significance. These

variables together explained 98.90 percent variation in gross returns. The observed F-value was higher than the tabulated F value indicating regression to be significant. The elasticity coefficient for a gross return with respect to the explanatory variables, *i.e.*, fertilizer, irrigation and human labor were estimated to be 0.217, 0.301 and 0.434, respectively. This indicated that one per cent increase in expenditure increased the gross return by 0.434 per cent, 0.301 per cent and 0.217 per cent, respectively. Returns to scale of production on small farms was 0.952 implying decreasing returns to scale (Table 7).

Semi-Medium Farmers

Irrigation (X_6), machine labor (X_1) and plant protection measure (X_5) significantly affected the gross return on semi-medium farms. The regression coefficients for irrigation (X_6 = 0.613), machine labor (X_1 = 0.299) were estimated to be significantly positive at 1 per cent level of significance and plant protection measure (X_5 =0. 020) was significantly positive at 5 per cent level of significance. These variables together explained 98.60 per cent of the variation in gross return. The observed F-value was higher than the tabulated F value indicating regression to be significant. The elasticity coefficients for gross returns were estimated to be 0.613, 0.299 and 0.020 for irrigation, machine labor and plant protection measure respectively; indicating that one per cent increase in expenditure increased the gross return by 0.613 per cent, 0.299 per cent and 0.020 per cent, respectively. This implied that gross return was relatively inelastic to the changes in irrigation, machine labor and plant protection measure. The sum of elasticity coefficients, *i.e.*, returns to scale of production on these farms was 0.932 implying decreasing returns to scale (Table 8).

Table 8: Estimated Cobb-Douglas Production Function for Semi-Medium Farmers of Sikar

Dependent Variable (Y) = Gross Return Number of Farmers (N) = 20					
S. No.	**Explanatory Variable**	**Regression Coefficient**	**Standard Error**	**VIF**	**Elasticity Coefficient**
1.	Intercept (a)	1.607	0.108	-	-
2.	Irrigation (x_6)	0.613***	0.056	4.226	0.613
3.	Machine labour (x_1)	0.299***	0.059	4.443	0.299
4	Plant protection (x_5)	0.020**	0.008	1.142	0.020

Coefficient of multiple correlation (R) = 0.993; Coefficient of determination (R^2) = 0.986; Adjusted coefficient of determination ($\overline{R^2}$) = 0.983; 'd' statistic = 1.781; 'f' value (with 3, 16 d.f.) = 365.607; Returns to scale = 0.932; *** Significant at 1 per cent level of significance; ** Significant at 5 per cent level of significance

Medium Farmers

In case of medium farmers, irrigation (X_6 = 0.447), machine labor (X_1 = 0.395) and fertilizer (X_4 0.160) were found to be statistically significant. The regression coefficients for irrigation, machine labor and fertilizer were significantly positive at 5 per cent level of significance. These variables together accounted for 98.60 per cent of the total variance in the gross return. The elasticity coefficients for a gross return with respect to the selected explanatory variables, *i.e.*, irrigation, machine labor and fertilizer were estimated to be 0.447, 0.395 and 0.160. This implied that gross return was inelastic to the changes in expenditure on irrigation, machine labor and fertilizer. The sum total of elasticity coefficients was worked out to be 1.002 implying increasing returns to scale on such farmers (Table 9).

Table 9: Estimated Cobb-Douglas Production Function for Medium Farmers of Sikar

Dependent Variable (Y) = Gross Return Number of Farmers (N) = 14					
S. No.	**Explanatory Variable**	**Regression Coefficient**	**Standard Error**	**VIF**	**Elasticity Coefficient**
1.	Intercept (a)	1.368	0.174	-	-
2.	Irrigation (x_6)	0.447**	0.153	6.613	0.447
3	Machine labor (x_1)	0.395**	0.151	6.335	0.395
4.	Fertilizer (X_4)	0.160**	0.070	4.316	0.160

Coefficient of multiple correlation (R) = 0.973; Coefficient of determination (R^2) = 0.986; Adjusted coefficient of determination ($\overline{R^2}$) = 0.987; 'd' statistic = 1.755; 'f' value (with 3, 10 d.f.) = 235.082; Returns to scale = 1.002; ** Significant at 5 per cent level of significance

Large Farmers

On large farms machine labour (X_1) and irrigation (X_6) significantly affected the gross return. The values of VIF (variance inflation factor) for the two selected explanatory variables were estimated to be less than ten indicating no multicollinearity problem among these variables.

Table 10: Estimated Cobb-Douglas Production Function for Large Farmers of Sikar

Dependent Variable (Y) = Gross Return Number of Farmers (N) = 7					
S. No.	**Explanatory Variable**	**Regression Coefficient**	**Standard Error**	**VIF**	**Elasticity Coefficient**
1.	Intercept (a)	1.678	0.154	-	-
2.	Machine labour (x_1)	0.646***	0.087	1.251	0.646
3.	Irrigation (x_6)	0.204**	0.072	7.864	0.204

Coefficient of multiple correlation (R) = 0.997; Coefficient of determination (R^2) = 0.995; Adjusted coefficient of determination ($\overline{R^2}$) = 0.993; 'd' statistic = 1.963; 'f' value (with 2, 4 d.f.) = 389.394; Returns to scale = 0.850; *** Significant at 1 per cent level of significance; ** Significant at 5 per cent level of significance

The Durbin–Watson test also indicated no autocorrelation (neither positive nor negative) among the estimated residuals. The regression results revealed that the coefficient of machine labor (X_1 = 0.646) was significantly positive at one per cent and that of irrigation (X_6 = 0.204) was negatively significant at 5 per cent level of significance. These explanatory variables together accounted for 99.50 percent variation in the gross return. The observed F-value was higher than the tabulated F value indicating regression to be significant. The elasticity coefficients of gross return with respect to both the explanatory variables indicated that one per cent increase in expenditure on irrigation and plant protection increased the gross return by 0.646 per cent and 0.204 per cent, respectively indicating the gross return to be relatively inelastic to the change in irrigation and plant protection. The returns to scale of production on large Sikar farms were 0.850 implying decreasing returns to scale (Table 10).

CONCLUSIONS

Thus, the geographical and professionalism of farmers of two district viz. Sikar and Jaipur were investigated to compare the resource use efficiency of fenugreek crop. Out of seven explanatory variables, only four variables, namely; machine labor, seed, irrigation and human labor for Jaipur district and machine labor, seed, fertilizer and human labor for Sikar farms were significant factors influencing gross return.

REFERENCES

1. *Kumawat, D.K., Kumawat, R. and Jheeba, S., 2016. Growth rates and instability in area, production and productivity of fenugreek in the state of Rajasthan. Annals of Agricultural Research, 37 (4): 445-452.*
2. *Kumawat, D.K., Kumawat, R. and Jheeba, S., 2017. Study of the resource use efficiency of fenugreek crop in the state of Rajasthan. International Journal of Agricultural Science and Research, 1(7), pp.29-42.*
3. *Lindara, L.M., Johnsen, F.H. and Gunatilake, H.M., 2006. Technical efficiency in the spice based agroforestry sector in Matale district, Sri Lanka. Agroforestry systems, 68(3), pp.221-230.*
4. *Nimoh, F., Tham-Agyekum, E.K. and Nyarko, P.K., 2012. Resource use efficiency in rice production: The case of Kpong Irrigation Project in the Dangme West District of Ghana. International Journal of Agriculture and Forestry, 2(1), pp.35-40.*
5. *Singh, S. P., Beena, J., 1996, Resource use efficiency in cash crops of Pune district (Maharastra). Agricultural Situation in India, 52(7); 507-512.*